Competitive Behavior of National Brands:

The Case of Orange Juice

by

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Introduction

The leading fruits in terms of US per capita consumption are bananas, apples, and oranges. Virtually all bananas are consumed fresh, as are the majority of apples. But more than half of the orange crop is processed into juice, either frozen concentrate, refrigerated from concentrate, or refrigerated not-from-concentrate. A much smaller quantity is canned for shelf stable juice. (USDA reference) Consumption of all types of juice is increasing, and for oranges this has resulted in stable over-all consumption, for fresh orange consumption has recently declined.

Initially frozen concentrate dominated the retail orange juice market. As packaging and transportation developed, greater convenience was provided to the consumer with the introduction of refrigerated orange juice made from concentrate. With increasing consumer awareness of product quality and health attributes, additional orange juice variants were introduced to capitalize on these shifting consumer tastes. The orange juice market is characterized by a group of national brands, with a large position also held by private label and by regional brands. The national brands produce both frozen and chilled juice, and they typically produce them in more than one variant, such as calcium enriched, country style, and reduced acid, differing in specific characteristics and presumably quality.

Product variation can be a means to segment the markets and engage in price discrimination. The introduction of quality-enhanced orange juice helps to isolate them from private label competition, who typically only produce "plain" juice. It has been argued that brand proliferation and promotion are anti-competitive strategies employed by large food companies against smaller rivals who cannot maintain diverse product lines. (Cotterill; Connor). For example, a firm may introduce quality-enhanced versions of standard products that appeal to higher income,

less price-responsive consumers and for which there are fewer direct competitors. More nutritious versions of standard products, such as extra vitamin cereals or low fat snacks, often sell for higher prices than corresponding regular versions, in part due to higher costs but perhaps because food companies view consumers concerned with nutrition as less resistant to higher prices.

The purpose of this study is to examine orange juice demand, focusing on the main forms frozen and chilled, and considering the role of brands, private label, and product variety. Because refrigerated orange juice is generally viewed as being superior to frozen, both in terms of flavor and convenience, demand and demand elasticities may be significantly different. In addition, private label has a much larger share of the frozen concentrate market, 38% versus 15% in chilled, which is also likely to cause different competitive behavior in the frozen and refrigerated market segments. A reasonable expectation is that demands for the two types and their variants will not be the same.

Literature Review (in process)

McEnally and Hawes, Szymanski and Busch, and later Richardson et al. provide overviews of consumer demand for private label. While some determinants show a consistent pattern of effects, "the results concerning socio-economic correlates of private brand proneness are somewhat mixed." (Richardson et al. p.160). Among the consistent factors are education and household size, both positively associated with store brands. Higher income is generally found to have the opposite effect, but surprisingly, studies have also found very low-income consumers reluctant to purchase store brands. Coe found that "lower-income respondents depended on advertising as a source of information…and equated quality with price." (p.68)

In a recent study, Hoch used store-level scanner data from a Chicago chain and regressed private label share of fourteen products on store level demographics. He found significant positive effects for measures of age, education, family size, and prevalence of working women, with negative impacts for income and housing value. He did not include an explicit measure for low income.

Historically, private labels have had a greater presence in the frozen and refrigerated categories (20.4 and 15% in 1989, than in health and beauty aids, 4.4%)[1] Orange juice has been the focus of several demand studies. This analysis builds on this previous work. However, previous studies have used either household data or national aggregate data. We are aware of no studies that have used detailed sales and quantity data for market areas.

Brown et al found that "High US OJ demand, which in part has been the result of advertising, has attracted substantial amounts of OJ imports. The imports have eroded the impact of advertising on price by an estimated two-thirds."[2]

Cotterill et al. found that "it appears as though price is not an important strategic weapon when private label share is low, but becomes increasingly important in categories where private label share is high."

[1] How Should National Brands Think about Private Labels?, Hoch, Stephen J. Sloan Management Review, Winter 1996

[2] Brown, Lee & Spreen The Impact of Generic Advertising and the Free Rider problem

Data

The data, supplied by Sales Area Marketing, Incorporated (SAMI), a major grocery product tracking firm, consist of annual average prices and quantities of the various types and brands of juice for each of 54 major US market areas, accounting for approximately 85% of US sales. We also have data for frozen and shelf-stable apple juice and shelf stable blended juices, which are the only potential competitors with orange juice that have large market shares. The 54 areas are county aggregates, for which we have constructed demographic data by aggregating county census data. The estimation will involve price equations and a system of demand equations, and will include the role of demographics. We are interested in demand and price differences across the brands and types, and how this may be affected by demographics and competitive factors.

We have data for 1989 and 1990. This is especially advantageous, for two reasons. During this time, there were three major national brands, Minute Maid, Tropicana, and the recent entrant Citrus Hill, and these were engaged in strong rivalry. Of more importance, however, is that freezing temperatures in Florida and Texas in December of 1989 significantly lowered prospects for U.S. citrus crops.[3] On September 1, 1990 the Florida Citrus Producer's Association reported that only 90.3 million gallons of concentrate had been packed from domestic fresh fruit at that time, down 48 percent from 1989. To supplement the smaller pack, Florida processors imported 61.5 million gallons of concentrate through the last week in August, a 98 percent increase over 1989.[4] Nevertheless, total supply was significantly reduced.

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[3] USDA Situation and Outlook Report, Fruit and Nut Trees, March 1990
[4] USDA Situation and Outlook Report, Fruit and Nut Trees, September 1990

As a result, prices rose. According to US Bureau of Labor Statistics Average Price Data, in December of 1989, the retail price of a 16 ounces of frozen concentrated orange juice averaged $1.80/lb. Following the December 1989 freeze and the subsequent supply reduction, this increased beyond $2.00/lb, peaking at $2.29/lb in July of 1990. Prices averaged $2.02/lb in December of 1990, up 12.5% from the prior year.

Therefore, we will be able to study not only cross-sectional demand, but also differences in the degree to which sudden but temporary farm price increases affect retail price for different qualities and types of juice, the consumers response to increases, and the extent to which this depends upon the presence of private labels and regional brands. This will provide insights into the important question of whether product diversity is likely to be used by national firms to avoid price competition.

Orange Juice Market

Table 1 presents 1990 national data for major juices and juice drinks. The combined orange juice group has the leading position. The only other categories of consequence are shelf stable apple juice and shelf stable blended juice, the latter comprised of a broad range of varieties such as cranberry juice cocktails, sports drinks, and juice-containing drinks like Hi-C. This sales data is mirrored in USDA figures for national per capita fruit juice consumption (Putnam and Allshouse, 1997). More specifically, per capita consumption of orange juice was at 4.27 gallons in 1990, down from 5.11 in 1989, reflecting the effect of the short supply.[5] This compares to 1.45 gallons for apple and .5 gallons for pineapple, the closest followers among fruit juices. However,

[5] Food Consumption, Price and Expenditures

among all non-alcoholic drinks, orange juice is behind milk, coffee, and carbonated soft drinks, with 1990 per capita consumption in gallons at 25.7, 26.9, and 46.3, respectively.

Within orange juice, the refrigerated type is by far more important in terms of sales than are frozen and shelf stable. However, in terms of consumption, this is deceptive. Frozen orange juice is a concentrate, and after the addition of the standard three parts water, consumption on a ready-to-drink basis is nearly on a par with refrigerated. In table 2, appears per capita orange juice consumption in 1989 for all 54 areas in our sample, in total and in the two major forms, along with average prices. The averages in the table are all considerably less than the USDA figure presented above because Table 2 applies only to that portion sold by supermarkets, omitting that from restaurants, vending machines, schools, and other institutions. There is a surprising degree of variability across the markets. Total consumption (which includes shelf stable) varies from a low of 1.95 gallons per capita in Shreveport to 4.76 in New York. Average consumption in the East, the region with the greatest consumption, exceeded that in the Midwest, that with the least, by slightly more than one gallon per capita, and the West by nearly as much. In 1990, Eastern and Southern consumers displayed a preference for refrigerated juice, while the Midwest and especially the West emphasized frozen. In the case of the South and West, this pattern may well be a price response. In nearly all markets chilled juice is more expensive than frozen, with the difference often exceeding one dollar per gallon. But chilled price is lowest in the South, and it averages nearly one dollar less than the high priced West. The regional prices reflect the large difference in transport costs for the two product types. Shipping is a trivial consideration for frozen concentrate, so that differing transport costs have little effect on the geographic price pattern. Indeed, average price is lowest in the West, despite being farthest from

the Florida processing area. This is certainly not true for chilled juice. Not only does it involve an additional three parts water, adding considerably to bulk, it is much more perishable, generating inventory and other logistic problems not faced by its frozen counterpart. As a result, its price varies with distance from Florida.

Since 1979, virtually all the growth in orange juice consumption can be attributed to the refrigerated segment. The trend has continued as consumers regard the refrigerated, ready to drink segment as high in quality and convenience. However, in a February 1995 study Consumer Reports found that frozen concentrate was always the best value and in many cases has the best taste. Indeed, the highest rated national brand was standard, unenhanced plain Minute Maid frozen concentrate, beaten only by Consumer Reports' fresh squeezed and an expensive regional chilled brand.

Chilled juices are made from concentrate, except for those designated "premium," which are made from fresh oranges. These usually carry higher prices and presumably are of superior quality. However, Consumer Reports declared that "in sampling 36 orange juices, we found that the term 'premium' – used on containers of chilled orange juice that aren't made from concentrate – doesn't guarantee a particularly tasty product." Furthermore, Consumer Reports found that the quality of juices from a single brand can vary greatly. For example, Tropicana's orange juice products are scattered throughout the ratings.[6]

[6] Consumer Reports, Orange Juice. How Far from Fresh? February, 1995 Vol 60, No.2; Pg 76

National Brands

In table 3, we present extensive data on the orange juice market as represented in our sample data. Included are 1989 sales shares. By these, Minute Maid appears to be the most important producer, with nearly one-third of frozen sales and 25 percent of refrigerated. However, Tropicana's major position in the chilled segment, which has much higher total sales, makes it the market leader in terms of total dollar sales, with $810 million in 1989, compared to Minute Maid's $726 million. Citrus Hill is the smallest national brand, with about 10 percent of each category and 1989 sales of $308 million. Private label (which of course is not a single firm) is clearly a major factor in the orange juice market. It is especially important in the frozen category, which is not surprising since frozen is the economy form of orange juice, and private label is usually considered the economy "brand" in any category.

Tropicana was founded in 1946 and has always been the leader in chilled, ready-to-drink orange juice. The company changed a commodity industry into one that can carry a price premium, especially with the 1988 nationwide introduction of its Pure Premium brand of not-from concentrate juice. Seagrams purchased Tropicana at that time, but later sold the company to PepsiCo in 1998. This acquisition equalized PepsiCo's's's position with its rival Coca-Cola, which purchased Minute Maid in 1960 and turned it into a major food brand. Minute Maid has always held a dominant position in frozen concentrate. But in order to capitalize on the booming refrigerated market, Minute Maid introduced Minute Maid Premium Choice in May 1988 as a direct competitor with Tropicana's Pure Premium Original. Unfortunately, Minute Maid had only entered this premium juice into 15 of the SAMI markets by 1990, compared with Tropicana's penetration into all 54 SAMI markets.

Citrus Hill arose much later than Tropicana and Minute Maid. Hoping to match its previous success with Jif peanut butter years earlier, Procter & Gamble entered the orange juice market by creating this brand in 1982. In 1987, it became the first to introduce a nutritionally enhanced product, a calcium-added orange juice. Minute Maid soon followed. This remained Citrus Hill's only product variant. Tropicana entered a calcium-enriched line much later--- in this period it was focusing on its premium chilled juice.

In addition to shares, Table 3 has extensive price information, in the form of 1989 average prices for all the varieties of frozen and chilled orange juice and the corresponding 1990 price increases. The price advantage of the frozen concentrate form is clear, being over 20 percent cheaper. Within each category, private label is by far the cheapest, with the minor brands group being somewhat below the national brands. Among the latter there is considerable variation.

A notable aspect of the prices is that the leading brands in each category --- Minute Maid for frozen and Tropicana for chilled --- also have the highest prices in those categories. While on the one hand this might reflect dominant firm behavior, a more charitable view must recognize that a leading position can be due to a quality advantage, which implies potentially higher costs. Some support for this can perhaps be combed from the Consumer Reports' test previously noted, at least with respect to frozen.

In all cases, including regional brands and private label, the average 1990 price increase for chilled juice exceeds that for frozen concentrate, often by several cents. Since each type presumably uses the same amount of oranges to make a given quantity of ready-to-consume juice, there is no obvious justification for this difference. One hypothesis is that it reflects exploiting a

more inelastic demand for chilled juice. The fact that Tropicana raised the price of premium chilled juice more than that of reconstituted chilled might be similarly interpreted. However, there is a cost basis for this. Premium does not use concentrate, and the influx of Brazilian concentrate in response to the freeze should have lowered the Florida price of concentrate relative to that of unprocessed oranges. Nevertheless, the information in the table supports a hypothesis that manufacturers use-- at least implicitly--elasticity differences in setting their prices.

These higher prices induced by the short supply came during a period of spirited competition in the orange juice market, headed by the battle between Minute Maid and Tropicana for market share in the increasingly important refrigerated segment. The period saw price discounting and increasing levels of promotion. In July of 1988, the battle became fierce as Tropicana sued Coca Cola over their Minute Maid advertisements, claiming false and deceptive advertising. Coca-Cola dropped the line "orange juice straight from the orange" in order to avoid litigation. During this time Minute Maid began introducing Minute Maid Premium Choice to match Tropicana Pure Premium Original, and both companies increased advertising in 1989, by 49.9% and 29.2%, to $28.9 and $33.3 million, respectively (Leading National Advertisers). But Citrus Hill chose a different strategy, decreasing advertising 34.5%, to $13.2 million.

In 1990, the year of the freeze, Tropicana remained the leader with $28.8 million in expenditures. In the face of the higher prices, Minute Maid changed its strategy and reduced expenditures considerably, to $12.7 million, less than half of the previous year. Perhaps Citrus Hill viewed this as an opportunity to become a more aggressive marketer, for it increased advertising spending to $17.1 million, and in April replaced its standard Citrus Hill Select with Citrus Hill Fresh Choice, with the pitch that it is made from oranges that are "picked and

squeezed" the same day, a dubious claim since Fresh Choice was still made from concentrate. Despite this ploy, it was not long after that Procter and Gamble decided that it could not break the market grip of its entrenched rivals: in 1992, it discontinued the Citrus Hill brand and sold its processing plants to Cargill.

The Effects of the Freeze on the Market

According to SAMI data, supermarket orange juice sales were $1.85 billion in 1989: the higher 1990 price and its associated reduced quantity combined for virtually unchanged sales in the year of the freeze: $1.87 billion. However, the market shares of the three national brands were not unchanged. Despite the flat growth in the orange juice market, Tropicana sales increased to $899 million in 1990, an increase of 11% from 1989 levels. Conversely, Minute Maid sales decreased to $699 million, a drop of nearly 4%. Sales of Citrus Hill dropped even more, by 12% to $270 million. Advertising expenditures may have played a key role in Tropicana's increase in market share. As just noted, Minute Maid decreased overall spending; and much of this was spending in the ready-to-serve chilled segment. Citrus Hill, although its promotion spending rose, the increase was less than the reduction of the previous year. Tropicana had maintained its large advertising budget, with nearly 95% of expenditures devoted to the refrigerated category.

To examine the shifting more closely, table 3 displays, for the two categories, two additional variables: S, the ratio of the dollar sales of each variety in 1990 to that in 1989, and Q, the corresponding measure for quantity sold. From the Q's we see that the quantity of virtually

every form of orange juice fell, or at best did not change.[7] In the aggregate, the 1990 volume was about 88% that of 1989 for both categories. Sales for chilled increased 5%; sales for frozen were unchanged. In addition to Tropicana's sales gains, we see that private label and especially regional brands also gained. The performance of the latter is especially surprising in that they did particularly well in the refrigerated segment, where promotion by national brands was especially keen. The loss of market share by Minute Maid and Citrus Hill is evident in the table.

Within frozen concentrate, the sales of private label, regional brands, and Tropicana increased. Those of Minute Maid and Citrus Hill fell. The common factor appears to be the magnitude of the 1990 price increase: that for the first group was significantly below that for the second. Citrus Hill is a case of particular interest. It suffered a sharp sales reduction, although its price increases were only modestly higher than Minute Maid's, whose sales declined considerably less. Here the difference appears to be the 1989 prices. Citrus Hill had pursued a low price strategy, with the lowest price of the national brands. As a consequence, it is likely to have attracted the most price sensitive of those consumers who prefer national brands. The abrupt change in policy is likely to have driven many of these away, especially to the now cheaper Tropicana, as the table suggests. In short, Citrus Hill committed a major marketing blunder, leading to a large reduction in market share, probably a major factor in the brand's exit from the market less than two years later. On the other hand, Tropicana appears to have recognized the importance of price in this segment, for its success is attributable to its maintenance of a low price strategy during the period.

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[7]The growth of Minute Maid Pulp Free is due to its being a new variety, introduced in late 1989. We prorated the 1989 data to reflect this. The growth shows new product penetration.

Within the chilled category, the evidence of price sensitivity is weaker, although the realignments of market share are similar. Private label, the traditional price competitor, fared less well than within the price-sensitive terrain of frozen concentrate demand, although it is the brand with the smallest price increase. Except for this and for Tropicana's two premium brands, the price increases were similar. It is the case, however, that the three standard varieties with sales gain (Tropicana T-O-J, Tropicana Homestyle, and the regional brands) have slightly smaller price increases than the remaining brands. Price is not without effect. However, the fact that Tropicana's expensive premium juices also had relatively small volume declines and quite large sales increases shows price is not the guiding factor. Similarly, it is clear that Tropicana's success in this category is not due to a policy of competitive pricing. More likely factors are its greater emphasis on premium juices and its greater promotion during this period than what characterized its national rivals.

We explore these issues further in the next section, where we estimate a system of orange juice demands. We also examine the question of whether orange juice pricing for the various types is variety-dependent and a function of demand factors, in particular, buyer, characteristics. We pursue this with regressions of price changes on market profiles.

Orange Juice Demands

The goals of examining orange juice demand at the market level are two fold. First is the desire to see what demographic/regional sensitivities these demands show. The data shows that the national brands are concentrating on the refrigerated segment of the market. This leads to the expectation that income as a demographic would have a strong positive effect on the demand for refrigerated juice. Also, of policy interest is whether low income consumers buy branded

products over the cheaper private label alternatives. It is commonly held that they do not but prior research suggests the contrary (Coe,1972; Binkley 2000). We include an education variable, percent of college graduates, as an information variable. If the quality image of chilled juice has little basis (as Consumers Reports suggests) we expect educated consumers to be more aware of this. For the same reason, they should buy more private label brands. We also include a variable measuring the percent of population under 15 in order to account for effects due to the imperious demands of children.

Advertising effects appear to be important in this market but they are difficult to measure. We use a variable from another study meant to measure market advertising responsiveness (Binkley, 2000). This is based on SAMI data for market-level shares of 59 cereal brands and Leading National Advertisers data on national advertising by these brands. The responsiveness of a market is determined by whether highly advertised cereals have a larger or smaller share in the local market than they have in the national market.

The other goal for demand estimation is to examine the own-price elasticities of the various products. Given the sales increases for many of the products in spite of price increases of between 10 to 20%, we expect to find demands to be inelastic, especially the three national brands and especially refrigerated juices.

To analyze demand for orange juice in the 54 SAMI markets in 1989 and 1990, a linearized version of the Almost Ideal Demand System (AIDS; Deaton and Muellbauer) is employed. The AIDS price index is approximated by a logarithmic analogue to the Paasche index (Moschini). This approach to linearization of the AIDS model is shown by Moschini and by Asche and Wessells to perform well. The reader interested in details of the AIDS model should

consult Deaton and Muellbauer or any one of the hundreds of papers which have employed this model. The n-category models estimated are:

$$w_i \quad \alpha_i \quad \sum_{k\ 1}^{K} \delta_{ik} DEMOG_k \quad \sum_{j\ 1}^{n} \gamma_{ij} \ln p_j \quad \beta_i \ln(x/P) \quad \varepsilon_i \quad i \ \ 1, ..., n \qquad \textbf{(1)}$$

where w_i is the expenditure share of juice i for i = 1, ... , n-1, $DEMOG_k$ is the kth regional or demographic variable, p_j is the price of category j, x is total expenditure for orange juice, α, δ, γ, and, β are unknown coefficients, and ε_i is the error term for category i. The logarithmic analogue of the Paasche price index, ln P, is:

$$\ln P \quad \sum_{j} w_j \ln (p_j/\bar{p}_j) \qquad \textbf{(2)}$$

and $\bar{p}_j$ is the sample average of the jth price. Models are estimated with homogeneity and symmetry imposed. Means of prices and expenditure shares are given in table 3. Those for the regions and demographics employed are listed in table 4.

To simplify the model and presentation of results, the three national brands were aggregated for refrigerated and for frozen (Big 3). These along with refrigerated and frozen regional (Other) and private label (PL) comprise six commodities. Finally, total shelf stable orange juice is included (SS), yielding a seven-good model, which is assumed to be separable from all other goods.[8] The model is estimated separately for 1989 and 1990 because of the high

[8] Early versions of the demand models included apple and blended juices. Neither showed any significant interaction with any of the orange juice categories. These categories were dropped to simplify the demands.

correlation of the errors in a given market between the years. Model estimates for 1989 are in table 5 and those for 1990 are in table 6. Shelf stable juice demand was dropped during estimation and as the results were of little interest, they are not included in the tables.

The explanatory power of the models is reasonable and consistent across the years. The signs of the estimated coefficients are consistent across years, as well, especially for significant determinants. The regional effects mirror the data in table 2, namely, a preference for chilled juice in the East and South. They also suggest that the East is the most "brand-oriented" region, while the West is the most given to buying private label. As expected, income has a positive effect on refrigerated, especially branded, and a negative effect on frozen, especially private label. College has exactly the opposite effect, showing a decided preference for frozen private label. Since there is no reason for education to make consumers inherently prefer this type, we interpret this as representing the ability to go beyond "image" and to purchase more on price.

The effect of an increased percentage of the population below the poverty line is to significantly decrease the consumption of regional and private label frozen concentrate, and to increase the consumption of big 3 refrigerated. This is the opposite of what is usually thought, but as noted above, agrees with previous research, particularly the reaction to private label. Certainly this is an issue warranting explicit study. The results for the advertising measure, while statistically weak, are generally of the expected sign. A possible reason for the anemic response is the disparate advertising practices of the national brands, confounding the impact on the aggregate of them. In most cases, the children variable is of no consequence, and its large t-value in the frozen other brand equation is best interpreted as a type I error. As a general point, we note that all of the effects are consistent across the years without exception.

At the bottom of table 6, forecast R^2s are reported. These are calculated by using 1989 demand estimates and 1990 prices and expenditures to forecast 1990 shares. The actual 1990 shares are regressed in these forecasts, resulting in the forecast R^2s. The closeness of the forecast R^2s to those from the 1990 demand estimates is evidence that the demand for these products did not change between these two years.

As price and expenditure coefficients are difficult to interpret, the corresponding elasticity estimates are given in table 7. The elasticity estimates given in the table are actually the result of Monte Carlo simulations of each model. This is done for two reasons. First, a number of researchers have warned against the use of asymptotic standard errors when evaluating the significance of estimated elasticities (Dorfman, Kling, and Sexton; Green, Hahn, and Rocke; Miller, Capps, Jr., and Wells). Krinsky and Robb show that the Monte Carlo approach works well. Second, some of the categories of orange juice are found to be gross complements, which doesn't agree with intuition, other categories are found to be weak gross substitutes and it is desirable to get some sense of how significant such results are. The Monte Carlo experiments take the prices and real expenditure as fixed. For each model, multivariate normal errors are drawn having covariance matrix equal to that estimated for that year and added to the predicted shares from the original model estimates. Then these new shares are used to re-estimate the model. This is repeated 1000 times. Results are used to calculate estimated elasticities and their T ratios for each model.

The results for 1989 are given in the top half of table 7; those for 1990 are in the bottom half. Elasticities whose T ratio is larger than two in absolute value are indicated by an asterisk. All seven orange juice demands are very own-price elastic and all but PL frozen in 1990,

significantly so. But private label chilled is extremely elastic, more than twice as elastic as the national brands, which are the least price elastic for both types. Big 3 frozen juice is expenditure inelastic, while private label, refrigerated is expenditure elastic. Few of the off-diagonal elasticities are significant in 1989 and even less so in 1990. The most reasonable of these implies considerable substitution between national brands and private label in the chilled segment. This is also true for frozen but only in 1989, vanishing with the 1990 price increases.

Other significant effects involve regional brands, and these seem somewhat whimsical (eg that between other frozen and Big3 refrigerated). The heterogeneity of the regional group provides a convenient excuse for this, but it may well represent something we simply aren't capturing.

All demands are less elastic in 1990 than they were in 1989. This is reasonable. The across-the-board price increases certainly caused some consumers to exit the market, namely, the most price-sensitive. The remaining buyers would thus tend to be less price elastic. A similar effect may be behind the dramatic reduction in substitution between national brands and private label for frozen concentrate.

Price Regressions

Next, regressions of price changes and 1990 price levels on regional dummies and demographics are considered. The purpose is to investigate whether these are related to measurable market characteristics, which would be expected if there is third-degree price discrimination or other anti-competitive activity. Regions and demographic variables included in the regression are the same as in the demands with two additions, the percentage of the population over 65 (Over65) and female labor participation rates (Female), which are usually

thought important market measures by marketing professionals. In subsequent discussion, attention is centered on factors which significantly affect either price changes or levels, where an effect is deemed significant if the T ratio is larger than two in absolute value. Focus is on individual product categories, such as Tropicana Pure Premium Original orange juice, in hopes of shedding light on product proliferation as an anti-competitive strategy.

We present results only for chilled juice. For the frozen segment, we found little evidence that either price levels or changes follow any discernible patterns. The only brand for which we found significant effects was private label (eg higher prices in high income markets). An intimation that private label is the noncompetitive brand in this market is nonsensical, so we simply dismiss this as statistical error. Of more interest is the general absence of effects, because frozen concentrate is the least differentiated of the retail forms.

The latter point is given importance by the fact that we found a different picture for refrigerated juices. Results for both price change and 1990 price-level regressions are given in tables 8a-8f. Prices are high in high income markets for three of six categories, and in the other three the effect of income is fairly strong. They are also high in three of six markets with more children and four of six markets with more people over 65 and below the poverty line. They tend to be weakly lower in markets with higher education levels, the one exception being Tropicana T-O-J, the plainest and least expensive of the chilled brands. In short, there is some evidence that prices are being set with an eye to the strength of local demand.

This is supported by the price change regressions, which showed significant patterns for other brands, Minute Maid, and Citrus Hill, with similar but less significant patterns for the Tropicana brands. Price increases are larger in high income markets and in the South, where

frozen concentrate has less of a price advantage, which means that it is less of a competitive threat. Price increases are lower in markets with more college graduates. So again we see some evidence of price discrimination across markets. The R^2s for the categories are all about 0.60 for the price level regressions, except Tropicana PPO. The R^2s for the price change regressions are more variable. Other and Minute Maid are about 0.55, Tropicana TOJ is 0.46, Citrus Hill and Tropicana PPO are about 0.33, and private label is 0.15. The latter suggests private label is indeed least open to a charge of anti-competitive pricing.[9]

The odd categories in this mix are the two brands by Tropicana, the market leader. The market factors are never technically significant, but it is noteworthy that income was positive and nearly significant for PPO and not at all for the cheaper, from-concentrate TOJ. Both showed modest decreases in consumption, but healthy increases in sales in 1990, relative to 1989.

Summary and Conclusions

Evidence suggests that the three national brands were competing heavily, especially in the refrigerated juice categories in 1989 and 1990. One question of interest is: what would we expect to see in demand results and in price regressions, if the national brands were using a product proliferation as an anti-competitive strategy?

In the demands, we might expect to see little in the way of substitution between national brands and their regional and private label competition, especially in the refrigerated segment. While we found little substitution with regional brands, this was not the case with private label, particularly with refrigerated, for which we found significant substitution effects. We might also

[9] Furthermore, private label products are almost always priced in relation to their branded counterparts.

expect that big 3 brands would be significantly less responsive to price than either regional or private label, which we indeed did find. But this simply might reflect what few would question–that demands for nationally branded products tended to less elastic than are less promoted versions—and has little to say regarding proliferation.

In the price regressions, we would expect income to be a significant determinant of both the price level and the changes in price between 1989 and 1990. It was found to be significantly so for regional, private label, and Citrus Hill, and modestly so for Minute Maid and Tropicana. . It might also be expected that the changes in prices of differentiated products, like Minute Maid Plain and Tropicana PPO, would be more "explainable" in our price change regressions. Again, for the most part, this is the case. R^2s for private label's price change are the lowest, suggesting that there is no pattern to the increase in prices in 1990 for this category. Tropicana's two products price change R^2s are higher and that for Minute Maid is higher still. However, the highest of all is for the regional brands which certainly cannot be because of any national strategy.

Putting together all our evidence, our basic conclusion is that the problem of product proliferation, that is, the creation of brands with only marginal differences from existing brands simply to strengthen firms' market position, is not a major problem in the orange industry. Furthermore, there is no evidence of an assault on private labels. Indeed, the national brands appear much more focused on their peers. Prices in the refrigerated segment do show signs of discriminatory pricing, and the very existence of heavy promotion suggests this. But the alacrity with which buyers have increased use of chilled juice, especially the "premium" forms, is convincing evidence of nontrivial increases in consumer utility.

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Table 1. US Juice Sales ($1000)

Juice Type	1990 Sales
Orange	
Refrigerated	2,063,657
Frozen	1,229,182
Shelf Stable	259,356
Apple	
Shelf Stable	622,993
Frozen	171,165
Grape	
Shelf Stable	173,441
Frozen	118,400
Frozen Grapefruit	33,544
Frozen Lemon-Lime-Orange	140,156
Frozen Fruit Drinks	274,725
Shelf Stable Blended	2,094,093
Shelf Stable Pineapple	147,125

Table 2. Orange Juice Consumption and Prices by Region and Market

	Place	Frozen Quantity	Refrigerated Quantity	Total Quantity	Frozen Price	Refrigerated Price
East		1.29	2.59	3.95	3.76	4.90
	Albany	1.65	2.81	4.51	3.73	4.33
	Baltimore	1.28	1.57	2.91	3.88	5.07
	Boston	1.15	2.67	3.86	3.53	4.21
	Buffalo	2.06	1.48	3.70	3.50	4.63
	Hartford	1.14	2.96	4.16	3.97	4.52
	New York	0.89	3.82	4.76	4.02	5.32
	Philadelphia	1.40	2.20	3.65	3.86	4.72
	Pittsburgh	2.11	1.39	3.63	3.64	4.62
	Portland ME	1.80	1.97	3.83	3.21	3.98
	Scranton	1.31	2.08	3.47	3.81	4.35
	Syracuse	1.69	1.35	3.19	3.53	4.14
Midwest		1.57	1.28	2.93	3.70	4.53
	Charleston WV	0.80	1.55	2.47	3.69	3.86
	Chicago	1.51	2.04	3.64	3.78	4.70
	Cincinnati	1.31	1.58	2.93	3.62	4.24
	Cleveland	1.29	0.95	2.32	3.46	4.66
	Detroit	1.35	1.28	2.71	3.69	4.28
	Grand Rapids	2.47	0.87	3.44	3.76	4.66
	Green Bay	1.99	1.01	3.06	3.30	4.58
	Indianapolis	1.40	1.58	3.09	3.63	3.98
	Kansas City	1.52	0.99	2.63	3.75	5.00
	Milwaukee	1.95	1.21	3.22	3.33	4.45
	Minneapolis	2.01	0.86	2.92	3.95	5.12
	Oklahoma City	1.37	0.73	2.22	3.95	5.00
	Omaha	1.67	0.70	2.44	3.75	5.11
	Peoria	1.72	1.13	2.91	3.46	4.22
	Quad Cities	1.72	1.02	2.79	3.55	4.31
	St Louis	1.62	0.94	2.67	4.08	4.85
	Wichita	2.19	1.26	3.56	3.59	4.13

Table 2. Orange Juice Consumption and Prices by Region and Market (continued)

	Place	Frozen Quantity	Refrigerated Quantity	Total Quantity	Frozen Price	Refrigerated Price
South		1.10	2.02	3.29	3.58	4.06
	Atlanta	0.64	1.88	2.67	3.64	3.53
	Birmingham	0.79	1.65	2.62	3.36	3.50
	Charlston SC	0.64	2.19	3.03	3.20	3.53
	Charlotte	0.94	1.99	3.12	3.16	3.59
	Dallas	1.80	1.19	3.11	3.77	4.94
	Greenville	1.06	1.76	3.16	3.12	3.67
	Houston	1.33	1.19	2.67	4.06	4.59
	Jacksonville	0.88	2.77	3.79	3.31	4.07
	Louisville	0.94	1.71	3.02	3.57	3.82
	Memphis	1.71	1.96	3.87	3.80	4.45
	Miami	0.75	3.68	4.48	3.42	4.35
	Nashville	0.60	1.47	2.17	3.62	3.62
	New Orleans	1.67	2.52	4.44	3.68	4.12
	Norfolk	1.15	2.09	3.38	3.46	4.06
	Raleigh	1.17	2.61	3.92	3.22	3.57
	San Antonio	1.43	1.31	3.04	3.54	4.46
	Shreveport	0.72	1.13	1.95	3.64	4.31
West		1.75	1.21	3.04	3.54	4.99
	Denver	2.20	0.75	3.04	2.74	4.87
	El Paso	2.04	1.09	3.37	4.00	5.16
	Los Angeles	1.07	1.41	2.54	3.68	4.92
	Phoenix	1.63	0.88	2.59	3.78	5.61
	Portland OR	2.41	0.68	3.17	3.06	4.85
	Salt Lake City	3.14	0.62	3.88	2.98	4.71
	San Francisco	1.93	1.63	3.64	3.75	4.96
	Seattle	2.61	0.80	3.44	3.60	5.24
	Spokane	2.00	0.59	2.66	3.67	5.38

Table 3. 1989 Category Brand Shares, 1989 Prices, and 1990 Price Increases.[a]

	FROZEN					REFRIGERATED				
	1989 Share	1989 Price	Price Increase	S	Q	1989 Share	1989 Price	Price Increase	S	Q
Three Major Brands	.528	.51	.08	.95	.82	.681	.60	.11	1.04	.88
Citrus Hill	.127	.47	.09	.75	.62	.117	.56	.10	.98	.82
Plain	.045	.47	.09	.80	.60	.080	.56	.10	.94	.79
Calcium	.088	.47	.10	.72	.66	.037	.57	.11	1.05	.88
Minute Maid	.304	.53	.08	.98	.85	.256	.57	.11	.95	.80
Plain[b]	.219	.53	.08	.96	.84	.158	.56	.10	.92	.79
Calcium	.017	.52	.08	.78	.67	.032	.55	.11	1.07	.89
Country-Style	.038	.52	.09	.90	.77	.065	.57	.11	.94	.80
Pulp Free	.003	.53	.09	1.42	1.23	–	–	--		
Reduced Acid	.028	.62	.10	.89	.77	–	–	–		
Tropicana	.097	.48	.06	1.11	1.00	.308	.65	.11	1.11	.93
T-O-J	.068	.49	.06	1.11	1.00	.083	.61	.09	1.08	.94
Homestyle	.031	.48	.06	1.11	1.00	.039	.52	.08	1.09	.93
Pure Premium	–	–	–			.140	.71	.15	1.10	.91
Pure Premium Homestyle	–	–	–			.052	.69	.13	1.16	.98
Other Brands	.114	.45	.05	1.05	.97	.152	.56	.09	1.17	.97
Private Label	.364	.39	.06	1.06	.92	.168	.44	.07	1.00	.85
Category	1.000	.45	.08	1.00	.88	1.00	.57	.11	1.05	.88

[a]Averages of regional averages. Frozen and refrigerated are viewed as separate categories. Prices are in $/lbs of ready-to-consume orange juice.

[b]For Minute Maid there is no refrigerated orange juice without modifying labels (and hence "plain.") Minute Maid's simplest form of refrigerated juice is "premium homestyle."

Table 4. Descriptive Statistics of Regional and Demographic Variables.

	Average	Std. Dev.	Minim	Maxim	Explanation
East	0.20	0.41	0	1	=1 if the district is in the Northeast, 0 otherwise.
South	0.31	0.47	0	1	=1 if the district is in the East, 0 otherwise.
Midwest	0.31	0.47	0	1	=1 if the district is in the Midwest, 0 otherwise.
Income	13.68	2.08	9.97	18.94	Per capita income in $1,000.
Poverty	13.33	4.15	8.03	25.60	% of the population below the poverty line.
College	19.48	3.84	10.89	28.76	% of the population with at least a college degree
Children	21.89	1.98	18.67	30.10	% of the population that is 15 or younger.
Advertising	-0.09	1.11	-2.15	2.16	Measure of market sensitivity to advertising as explained in the text.

Table 5. Orange Juice Demands - 1989

	Other Frozen		Other Refrig		Big 3 Frozen		Big 3 Refrig		PL Frozen		PL Refrig	
	Coefficien t	T Ratio	Coefficien t	T Ratio	Coefficien t	T Ratio	Coefficien t	T Ratio	Coefficien t	T Ratio	Coefficien t	T Ratio
Other Frozen	-0.11	-2.04	-0.03	-0.88	0.00	0.08	0.00	-0.08	0.01	0.13	0.11	2.74
Other Refrig	-0.03	-0.88	-0.17	-4.72	0.05	1.21	-0.04	-0.74	0.13	2.67	0.04	1.21
Big 3 Frozen	0.00	0.08	0.05	1.21	-0.31	-3.12	0.00	0.01	0.23	2.49	-0.03	-0.59
Big 3 Refrig	0.00	-0.08	-0.04	-0.74	0.00	0.01	-0.27	-2.07	0.09	0.94	0.20	3.29
PL Frozen	0.01	0.13	0.13	2.67	0.23	2.49	0.09	0.94	-0.37	-2.59	-0.03	-0.53
PL Refrig	0.11	2.74	0.04	1.21	-0.03	-0.59	0.20	3.29	-0.03	-0.53	-0.29	-5.23
SS Total	0.03	1.23	0.01	0.62	0.05	1.88	0.01	0.29	-0.07	-1.97	0.01	0.28
OJ Expend	-0.02	-0.55	0.02	0.72	-0.07	-1.76	0.03	0.60	0.01	0.24	0.05	1.78
Intercept	0.08	0.49	0.22	1.66	0.40	1.94	-0.34	-1.49	0.46	2.11	0.06	0.41
East	-0.01	-0.43	-0.01	-0.25	0.02	0.53	0.12	3.30	-0.07	-1.95	-0.06	-2.35
South	0.01	0.39	0.04	1.83	-0.02	-0.66	0.04	1.16	-0.10	-3.34	0.03	1.36
Midwest	0.02	0.76	-0.03	-1.61	0.04	1.60	0.05	1.53	-0.03	-0.90	-0.05	-2.54
Income	-0.10	-1.26	0.04	0.65	-0.14	-1.43	0.47	4.45	-0.32	-3.41	0.11	1.54
College	0.00	-0.18	0.00	-0.95	0.01	1.46	-0.01	-1.20	0.01	1.83	-0.01	-2.38
Children	0.01	2.65	0.00	-1.02	0.00	0.52	0.00	-0.37	0.00	-0.19	-0.01	-1.62
Poverty	-0.01	-4.14	0.00	-1.60	0.00	0.38	0.02	5.13	-0.01	-2.47	0.00	-0.02
Advertising	0.01	1.39	0.00	0.82	-0.01	-1.52	0.01	1.27	-0.01	-1.50	0.00	-0.39
R-Square	0.60		0.70		0.66		0.73		0.70		0.72	

Notes: Big 3 stands for the combination of Minute Maid, Tropicana, and Citrus Hill; Other for the brand with the next highest sales; and PL for private label. Critical values for probability of type I error of 0.05, 0.025, and 0.01 are 1.68, 2.02, and 2.42, respectively

Table 6. Orange Juice Demands - 1990

	Other Frozen		Other Refrig		Big 3 Frozen		Big 3 Refrig		PL Frozen		PL Refrig	
	Coefficient	T Ratio	Coefficient	T Ratio	Coefficient	T Ratio	Coefficient	T Ratio	Coefficient	T Ratio	Coefficient	T Ratio
Other Frozen	-0.10	-1.90	0.01	0.34	0.02	0.39	0.13	2.19	-0.10	-1.65	0.01	0.28
Other Refrig	0.01	0.34	-0.14	-3.51	0.07	1.49	-0.03	-0.62	0.09	1.67	0.01	0.27
Big 3 Frozen	0.02	0.39	0.07	1.49	-0.12	-1.10	0.02	0.26	-0.01	-0.06	-0.04	-0.71
Big 3 Refrig	0.13	2.19	-0.03	-0.62	0.02	0.26	-0.16	-1.11	-0.05	-0.44	0.12	1.83
PL Frozen	-0.10	-1.65	0.09	1.67	-0.01	-0.06	-0.05	-0.44	-0.03	-0.19	0.11	1.74
PL Refrig	0.01	0.28	0.01	0.27	-0.04	-0.71	0.12	1.83	0.11	1.74	-0.22	-3.46
SS Total	0.03	1.24	-0.01	-0.45	0.05	1.55	-0.03	-0.68	-0.01	-0.18	0.01	0.28
OJ Expend	-0.01	-0.33	0.02	0.77	-0.11	-2.65	0.04	0.89	0.00	0.12	0.06	1.92
Intercept	-0.02	-0.12	0.12	0.90	0.35	1.68	-0.68	-2.96	0.79	3.60	0.26	1.58
East	-0.01	-0.37	-0.02	-0.66	0.03	0.92	0.15	3.86	-0.07	-1.85	-0.08	-2.75
South	0.01	0.44	0.01	0.49	-0.01	-0.30	0.05	1.22	-0.07	-2.01	0.01	0.46
Midwest	0.02	0.80	-0.04	-1.92	0.07	2.05	0.06	1.84	-0.03	-0.96	-0.06	-2.40
Income	-0.12	-1.53	0.12	1.78	-0.12	-1.22	0.60	5.64	-0.44	-4.79	0.04	0.53
College	0.00	0.08	-0.01	-1.62	0.01	1.67	-0.01	-2.14	0.01	2.64	-0.01	-1.68
Children	0.01	2.75	0.00	-0.63	0.00	0.43	0.01	0.77	-0.01	-0.91	-0.01	-2.34
Poverty	-0.01	-4.07	0.00	-1.02	0.00	0.77	0.02	5.21	-0.01	-3.01	0.00	0.09
Advertising	0.01	1.44	0.01	1.02	-0.01	-1.22	0.01	0.72	-0.01	-1.35	0.00	-0.43
R-Square	0.60		0.60		0.60		0.75		0.72		0.66	
Forecast R-Square[a]	0.56		0.58		0.64		0.72		0.61		0.62	

Notes: Big 3 stands for the combination of Minute Maid, Tropicana, and Citrus Hill; Other for the brand with the next highest sales; and PL for private label. Critical values for probability of type I error of 0.05, 0.025, and 0.01 are 1.68, 2.02, and 2.42, respectively

[a] Forecast R-Square are the result of using 1989 estimates and 1990 prices and expenditures to forecast 1990 shares and then regressing actual 1990 shares on these forecasts.

Table 7. Uncompensated Orange Juice Elasticities in 1989 and 1990

1989	Other Frozen	Other Refrig	Big 3 Frozen	Big 3 Refrig	PL Frozen	PL Refrig	Expenditure[a]
Other Frozen	-3.12*	-0.49	0.13	0.06	0.19	2.07*	0.65
Other Refrig	-0.34	-3.07*	0.60	-0.53	1.53*	0.46	1.24
Big 3 Frozen	0.03	0.28	-2.36*	0.13	1.12*	-0.11	0.67*
Big 3 Refrig	-0.01	-0.11	-0.01	-1.80*	0.27	0.57*	1.08
PL Frozen	0.04	0.83*	1.48*	0.60	-3.35*	-0.23	1.05
PL Refrig	1.13*	0.39	-0.45	1.97*	-0.48	-4.18*	1.58*
1990	**Other Frozen**	**Other Refrig**	**Big 3 Frozen**	**Big 3 Refrig**	**PL Frozen**	**PL Refrig**	**Expenditure[a]**
Other Frozen	-2.67*	0.22	0.40	2.41*	-1.85	0.20	0.80
Other Refrig	0.11	-2.60*	0.75	-0.44	0.98	0.08	1.23
Big 3 Frozen	0.13	0.41	-1.47*	0.30	0.05	-0.16	0.47*
Big 3 Refrig	0.37*	-0.11	0.04	-1.51*	-0.17	0.33*	1.12
PL Frozen	-0.65	0.57	-0.05	-0.32	-1.22	0.68	1.03
PL Refrig	0.07	0.03	-0.60	1.05	1.09	-3.39*	1.68*

Notes: Detailed results are in the appendix table A1. Big 3 stands for the combination of Minute Maid, Tropicana, and Citrus Hill; Other for the brand with the next highest sales; and PL for private label. Elasticities are computed at average expenditure shares for 1989 which are: .05, .08, .22, .35, .16, and .09 for other, frozen; other, refrigerated; big 3, frozen; big 3, refrigerated; private label, frozen; and private label, refrigerated, respectively. Average expenditure shares for 1990 are: .06, .09, .20, .35, .16, and .09 for other, frozen; other, refrigerated; big 3, frozen; big 3, refrigerated; private label, frozen; and private label, refrigerated, respectively.

[a] For expenditure elasticities stars indicate they differ significantly from unitary.

* Indicates the elasticity exceeds twice its Monte Carlo standard error in absolute value.

Table 8a. Demographic/Region Effects on Price Changes and Levels

Other Brand	Price Change		1990	
Refrigerated	Coefficient	T Ratio	Coefficient	T Ratio
East	0.030	1.45	0.020	0.35
South	0.050	2.64	-0.080	-1.22
Midwest	0.000	0.26	-0.050	-0.91
Income	0.250	3.98	0.490	2.30
College	-0.010	-2.45	0.010	0.65
Children	0.010	1.32	0.060	4.02
Female	0.000	0.74	0.010	1.30
Over65	0.000	0.36	0.070	5.37
Poverty	0.000	-0.11	0.030	2.41
Advert	-0.010	-1.22	-0.020	-1.27
Intercept	-0.300	-1.19	-4.520	-5.26
R-Square	0.56		0.62	

Table 8b. Demographic/Region Effects on Price Changes and Levels

Private Label	Price Change		1990 Price Levels	
Refrigerated	Coefficient	T Ratio	Coefficient	T Ratio
East	0.028	0.78	-0.191	-3.56
South	-0.026	-0.65	-0.310	-5.22
Midwest	-0.042	-1.29	-0.257	-5.20
Income	0.057	0.48	0.372	2.04
College	-0.006	-0.83	-0.014	-1.25
Children	-0.001	-0.08	0.021	1.61
Female	0.002	0.42	0.018	2.02
Over65	-0.006	-0.88	0.025	2.31
Poverty	0.000	0.04	0.016	1.84
Advert	0.001	0.08	-0.005	-0.36
Intercept	0.165	0.34	-2.701	-3.66
R-Square	0.15		0.62	

Table 8c. Demographic/Region Effects on Price Changes and Levels

Minute Maid Plain	Price Change		1990 Price Levels	
Refrigerated	Coefficient	T Ratio	Coefficient	T Ratio
East	0.040	1.84	-0.050	-1.19
South	0.090	3.67	-0.140	-2.92
Midwest	0.010	0.71	-0.010	-0.31
Income	0.000	0.34	0.020	1.65
College	-0.010	-1.23	0.000	-0.13
Children	0.000	-0.43	0.030	2.50
Female	0.000	1.15	0.010	1.76
Over65	0.000	0.31	0.020	2.60
Poverty	0.000	0.08	0.020	2.52
Advert	-0.010	-2.08	-0.010	-0.98
Intercept	0.010	0.04	-2.390	-4.11
R-Square	0.55		0.58	

Table 8d. Demographic/Region Effects on Price Changes and Levels

Citrus Hill Plain	Price Change		1990 Price Levels	
Refrigerated	Coefficient	T Ratio	Coefficient	T Ratio
East	0.010	0.24	-0.110	-3.37
South	-0.020	-0.83	-0.080	-1.96
Midwest	-0.010	-0.70	-0.030	-1.11
Income	0.170	2.49	0.320	2.83
College	-0.010	-1.98	-0.010	-0.70
Children	0.010	2.70	0.020	2.78
Female	0.010	2.98	0.010	1.31
Over65	0.020	2.88	0.030	3.23
Poverty	0.010	2.34	0.010	1.78
Advert	0.000	-0.23	-0.010	-0.62
Intercept	-1.050	-3.66	-2.070	-4.45
R-Square	0.34		0.57	

Table 8e. Demographic/Region Effects on Price Changes and Levels

Tropicana PPO	Price Change		1990 Price Levels	
Refrigerated	Coefficient	T Ratio	Coefficient	T Ratio
East	0.020	1.07	-0.090	-2.47
South	0.030	1.25	-0.060	-1.39
Midwest	0.030	1.86	0.010	0.34
Income	0.010	1.84	0.020	1.70
College	-0.010	-1.88	0.000	-0.21
Children	0.010	1.06	0.020	1.75
Female	0.010	1.85	0.000	0.66
Over65	0.000	0.89	0.010	1.77
Poverty	0.010	1.67	0.010	1.52
Advert	-0.010	-1.18	0.000	-0.19
Intercept	-0.430	-1.57	-1.200	-2.46
R-Square	0.33		0.46	

Table 8f. Demographic/Region Effects on Price Changes and Levels

Tropicana TOJ	Price Change		1990 Price Levels	
Refrigerated	Coefficient	T Ratio	Coefficient	T Ratio
East	-0.020	-0.86	-0.021	-0.31
South	0.015	0.58	-0.164	-2.24
Midwest	-0.006	-0.30	-0.017	-0.28
Income	-0.002	-0.31	-0.003	-0.11
College	-0.002	-0.43	0.016	1.12
Children	0.002	0.29	0.015	0.96
Female	0.003	0.72	0.009	0.81
Over65	-0.003	-0.54	0.025	1.87
Poverty	-0.001	-0.35	0.014	1.27
Advert	-0.008	-1.32	0.008	0.43
Intercept	0.069	0.22	-1.907	-2.10
R-Square	0.46		0.60	

Table A1. Uncompensated Orange Juice Elasticities in 1989 and 1990 and Their Ratios

	Other Frozen		Other Refrig		Big 3 Frozen		Big 3 Refrig		PL Froz		PL Refrig		SS Total		Expenditure[a]	
1989	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio
Other Frozen	-3.12	-3.28	-0.49	-0.92	0.13	0.14	0.06	0.05	0.19	0.18	2.07	2.98	0.52	1.43	0.65	-0.66
Other Refrig	-0.34	-1.01	-3.07	-7.78	0.60	1.22	-0.53	-0.95	1.53	2.84	0.46	1.26	0.12	0.64	1.24	0.85
Big 3 Frozen	0.03	0.15	0.28	1.50	-2.36	-5.68	0.13	0.37	1.12	2.94	-0.11	-0.47	0.25	2.08	0.67	-2.03
Big 3 Refrig	-0.01	-0.09	-0.11	-0.88	-0.01	-0.05	-1.80	-5.27	0.27	1.03	0.57	3.68	0.03	0.34	1.08	0.75
PL Frozen	0.04	0.12	0.83	2.94	1.48	2.79	0.60	1.03	-3.35	-4.19	-0.23	-0.66	-0.43	-2.11	1.05	0.24
PL Refrig	1.13	2.95	0.39	1.18	-0.45	-0.83	1.97	3.29	-0.48	-0.80	-4.18	-7.76	0.04	0.18	1.58	2.13
SS Total	0.59	1.45	0.26	0.81	1.18	2.09	0.38	0.60	-1.35	-2.01	0.17	0.38	-1.82	-5.50	0.61	-1.54
	Other Frozen		Other Refrig		Big 3 Frozen		Big 3 Refrig		PL Froz		PL Refrig		SS Total		Expenditure[a]	
1990	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio
Other Frozen	-2.67	-3.65	0.22	0.42	0.40	0.49	2.41	2.42	-1.85	-1.80	0.20	0.33	0.50	1.29	0.80	-0.41
Other Refrig	0.11	0.35	-2.60	-6.63	0.75	1.53	-0.44	-0.79	0.98	1.77	0.08	0.21	-0.11	-0.55	1.23	0.89
Big 3 Frozen	0.13	0.58	0.41	1.86	-1.47	-2.96	0.30	0.72	0.05	0.11	-0.16	-0.62	0.27	1.92	0.47	-3.13
Big 3 Refrig	0.37	2.44	-0.11	-0.73	0.04	0.18	-1.51	-3.97	-0.17	-0.53	0.33	2.06	-0.09	-0.90	1.12	1.08
PL Frozen	-0.65	-1.88	0.57	1.82	-0.05	-0.08	-0.32	-0.47	-1.22	-1.21	0.68	1.93	-0.04	-0.18	1.03	0.15
PL Refrig	0.07	0.20	0.03	0.09	-0.60	-1.04	1.05	1.69	1.09	1.79	-3.39	-5.48	0.06	0.23	1.68	2.23
SS Total	0.59	1.30	-0.17	-0.44	1.12	1.84	-0.53	-0.71	-0.09	-0.12	0.20	0.40	-1.89	-4.69	0.76	-0.76
	Other Frozen		Other Refrig		Big 3 Frozen		Big 3 Refrig		PL Froz		PL Refrig		SS Total		Expenditure[a]	
Ratios 90/89	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio	Elasticity	T Ratio
Other Frozen	0.86	1.11	-0.45	-0.46	3.09	3.47	43.07	44.81	-9.86	-10.30	0.10	0.11	0.95	0.90	1.23	0.61
Other Refrig	-0.33	-0.35	0.85	0.85	1.25	1.26	0.82	0.83	0.64	0.62	0.16	0.17	-0.92	-0.85	0.99	1.04
Big 3 Frozen	4.10	3.98	1.47	1.25	0.62	0.52	2.33	1.93	0.05	0.04	1.52	1.31	1.10	0.92	0.70	1.54
Big 3 Refrig	-26.71	-27.42	0.93	0.83	-3.91	-3.53	0.84	0.75	-0.63	-0.52	0.59	0.56	-3.18	-2.65	1.04	1.44
PL Frozen	-15.93	-16.33	0.69	0.62	-0.03	-0.03	-0.54	-0.46	0.36	0.29	-2.97	-2.93	0.09	0.08	0.98	0.64
PL Refrig	0.07	0.07	0.08	0.08	1.32	1.25	0.53	0.51	-2.30	-2.24	0.81	0.71	1.49	1.30	1.06	1.05
SS Total	1.01	0.90	-0.64	-0.54	0.95	0.88	-1.42	-1.19	0.06	0.06	1.19	1.04	1.04	0.85	1.26	0.49

Notes: Big 3 stands for the combination of Minute Maid, Tropicana, and Citrus Hill; Other for the brand with the next highest sales; and PL for private label. Elasticities and T ratios are based 1000 replications of each of the models in a Monte Carlo experiment. Average expenditure shares for 1989 are: .05, .08, .22, .35, .16, .09, and .05 for other, frozen; other, refrigerated; big 3, frozen; big 3, refrigerated; private label, frozen; private label, refrigerated; and shelf stable, total, respectively. Average expenditure shares for 1990 are: .06, .09, .20, .35, .16, .09, and .05 for other, frozen; other, refrigerated; big 3, frozen; big 3, refrigerated; private label, frozen; private label, refrigerated; and shelf stable, total, respectively.

[a] For expenditure elasticities stars indicate they differ significantly from unitary.